EXHIBIT J

— 161

STANDARDS PROJECT: Principles of User-Network Access Interfaces [redacted]
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TITLE: Multiplexing Structures for Broadband Interfaces

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NOTICE

Abstract

This contribution presents some ideas for consideration that may simplify multiplexing structures for broadband interfaces. It describes the manner in which the information payload capacity may be subdivided to provide bearer services flexibly.

1. Introduction

The USA contribution to CCITT Study Group XVIII on broadband interface structures[1] accommodates two approaches to subdivision of user information payload capacity. The abstract [2] for this USA contribution states:

> Two broadband interfaces are proposed, one of about 150 Mbit/s and another of about 600 Mbit/s. Each has a D-channel of at least 64 kbit/s. Signalling should be in the D-channel or in any channel being used for packet mode services. The interface payload (except for the D-channel) can be used for a flexible mixture of all bearer channels, including H_4, which are created on a per-call basis.

This permits flexible assignment of time slots for Synchronous Transfer Mode (STM) based services and further subdivision of synchronously derived channels by Asynchronous Transfer Mode (ATM)[1] packet techniques. Figure 1 depicts a frame based on this approach.

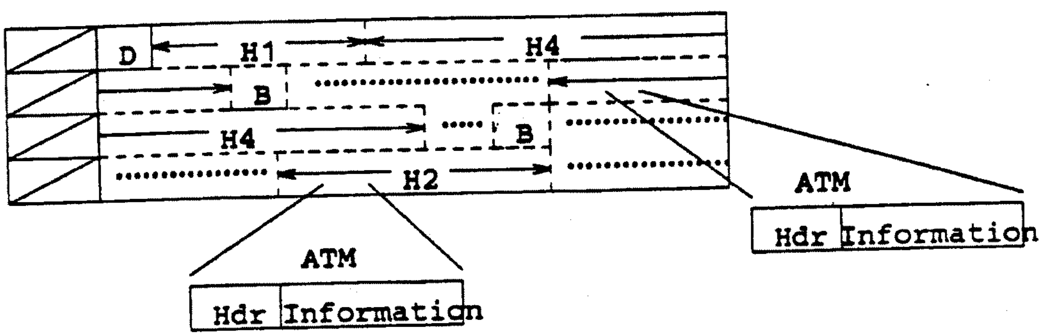

Figure 1. Multiple channel rates with ATM.

Solid lines logically represent fixed partitioning of capacity, while dashed lines represent flexibly assigned time slots. This multiplexing structure may complicate both user and exchange termination functions, since equipment with ATM capabilities must be implemented on top of flexible, multirate STM. Also, if ATM capabilities are available on channels of different rates, rate adaption functions would be necessary to benefit from a common packet switching fabric.

This approach can be further refined and strengthened. The next section presents some ideas for consideration that may simplify the multiplexing structure. It describes the manner in which the information payload capacity may be subdivided to provide bearer services flexibly.

1. Previously the New Transfer Mode, which replaced Asynchronous Time Division (ATD) and Asynchronous Time Division Multiplexing (ATDM)[3].

2. Multiplexing Structures For Broadband Interfaces

For purposes of this contribution, a "superchannel" is defined as the information payload capacity of a SONET STS-3 (about 144 Mbit/s). There is one superchannel in a 149.760 Mbit/s broadband ISDN interface, while four superchannels could be synchronously multiplexed on an STS-12 rate interface. No bearer services are offered at the superchannel rate. Each superchannel is synchronously subdivided into fixed size cells or blocks (see Figure 2). Each cell contains a fixed size header and a fixed size user information part. The header includes a logical address and possibly a header error check. Choices of values for N, M and S will determine how cells are packed into a superchannel. A frame of a superchannel does not have to be completely packed with cells. There can be an unused fragment.

A superchannel can carry services at a variety of bit rates. For example, based on a 5 octet header and 120 octet information part (i.e., N=5, M=120 and S=~~18~~ 90 in Figure 2), on the average, 88 out of 90 cells are required to transport an H_4-rate service, 27 out of 90 for an H_{22}-rate service (about 44 Mbit/s), and 1 out of 90 for an H_{11}-rate service (about 1.5 Mbit/s). Thus, a superchannel could concurrently carry broadband services, narrowband services and signaling.

All cells carrying information contain a logical address. It is also possible to reserve specific cells for specific virtual channels. In this way, it may be possible to simplify implementation of circuit-switched capabilities. For example, using the above numbers for N, M and S, 90 cells can be individually identified in 625 microseconds. 88 of these could be assigned to an H_4 for the duration of a call, 27 for an H_{21}, etc.

The STM mode discussed here is different from traditional STM in format. For a given "bearer channel", *octets* are not equally distributed within a frame. If multiple cells per frame are required for a connection, the *cells* can be distributed. This cell organization will incur some additional delay and buffering requirements.

3. Summary

This contribution introduced the idea of a slotted "superchannel" as a means to a possible common multiplexing structure for ATM- and STM-based interfaces to broadband ISDNs. This structure could support mixtures of bearer services up to and including H_4-rate services. A number of issues such as cell size, cell organization for particular bearer services, etc. remain for further study.

REFERENCES

1. United States of America, "Interface Structures for ISDNs Providing Broadband Services", Delayed Contribution CCITT-No. D.716/ XVIII, Geneva, June-July, 1986.
2. Sub-Working Party XVIII/1-3, "Part B 3 Report of Sub-Working Party XVIII/1-3 (Task Group on Broadband Aspects of ISDN)", CCITT TD.50 (XVIII/1), Geneva, June 30 - July 18, 1986.
3. "A Tutorial on Asynchronous Time Division Multiplexing (ATDM): A Packet Access Capability For Broadband Interfaces to ISDNs", by Mark Wm. Beckner and Steven Minzer, Bell Communications Research, T1D1.1/85-149, November 18-22, 1985.

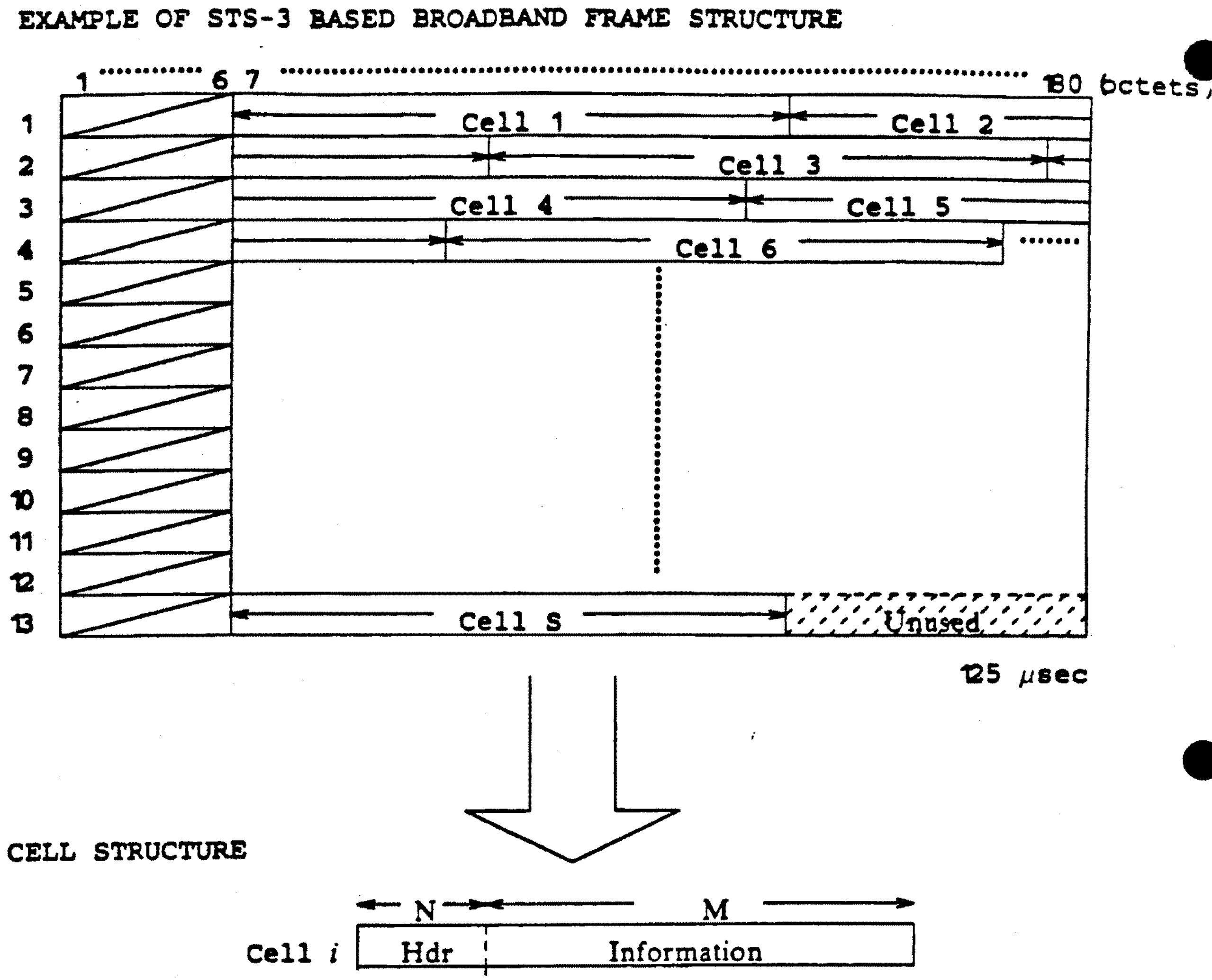

Figure 2. *Multiplexing structure.*